

Turning Pollution into Innovation: Zn and Se NPs Synthesized by *Pseudomonadota* from Zlate Hory mine

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Introduction. The prospective approach for nanoparticles (NPs) synthesis is the green, biologically mediated method, which utilizes bacterial species as reducing agents [1, 2]. These bacteria are capable of altering the chemical states of microelements and accumulating a diverse range of NPs both extra- and intracellularly [2]. The present study aims to compare the properties of zinc (Zn) and selenium (Se) NPs synthesized by metal-tolerant bacteria belonging to the phylum *Pseudomonadota*, primarily isolated from a former mine in the Czech Republic.

Material and methods. To characterize the synthesized NPs, advanced imaging techniques were utilized, including Scanning Electron Microscopy (SEM), Scanning Transmission Electron Microscopy (STEM), and Energy Dispersive X-ray Spectroscopy (EDX). These methodologies provided detailed insights into the morphological characteristics and elemental composition of the biosynthesized NPs.

Results. A total of 31 bacterial strains were isolated from Zn/Cu-enriched sludge and sinters samples, obtained from the underground Zlate Hory mine. Among these isolates, four species belonging to *Pseudomonadota* were selected for further investigation based on their ability to synthesize NPs. Minimum Inhibitory Concentration (MIC) tests revealed high bacterial tolerance to metal(oid)s such as Zn, Al, Cu, and Se, with resistance ranging from 2 mM to 8 mM.

Fig. 1. Selenium NPs on the surface of bacteria

Conclusion. As a result, Se and Zn NPs were localized in both extracellular (Fig. 1) and intracellular compartments of bacterial cells, depending on the species. The NPs exhibited various morphologies, with sizes ranging within hundreds of nanometers. These findings demonstrate the potential of utilizing metal-tolerant bacteria for the bioremediation of contaminated sites.

Keywords: *Pseudomonadota*, Zlate Hory, Zn and Se NPs biosynthesis.

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